iNEMI Project on Metals Recycling

SOW Review Session

10/31 10-11 AM EDT

Co-leaders
Adam Wheeler (IBM)
Carol Handwerker (Purdue)
Metals Recycling
Statement of Work Review

Agenda

• Introduction of Project Chairs
• Overview of iNEMI/Project Process
• Company participation in Statement of Work (SOW) development
• Introduction
• Project Details
• Summary and next steps
• Q&A

Note: All phones will be on mute until the end of the presentation
Metals Recycling

Project Leaders

• Adam Wheeler … IBM, Systems and Technology Group Product Environmental Stewardship Lead
  – B.S. in Computer Engineering and B.S. in Electrical Engineering from Iowa State University (2003), MBA from Cardinal Stritch University (2006)
  – Worked in hardware compliance for over 10 years including Product Safety, EMC, and Environmental Compliance
  – Leading development in the RoHS exemption transition since 2011, currently preparing for the 2016 transition
  – Holds multiple patents and publications on emerging battery technologies

• Carol Handwerker … Purdue University, Professor
  – Reinhardt Schuhmann Jr. Professor of Materials Engineering, appointment in Environmental and Ecological Engineering
  – Active in iNEMI Pb-Free and Environmental Initiatives and projects since 1999
  – Member of iNEMI Technical Committee and co-chair of the iNEMI Research Committee
  – Director of Purdue-Tuskegee IGERT Program in Sustainable Electronics, in collaboration with iNEMI
  – Former Chief of the NIST Metallurgy Division
International Electronics Manufacturing Initiative (iNEMI) is an industry-led consortium of around 100 global manufacturers, suppliers, industry associations, government agencies and universities. Working on advancing manufacturing technology since 1994.

Visit us at [www.inemi.org](http://www.inemi.org)
The Project Process - 5 Steps

1. SELECTION
2. DEFINITION
3. PLANNING
4. EXECUTION / REVIEW
5. CLOSURE

Open for Industry input

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iNEMI Technical Committee (TC) Approval Required for Execution

Limited to iNEMI Members

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Company Participation in SOW Development
Statement of Work (SOW) Development

Company Participation

- KXI
- IBM
- Umicore
- Purdue
- Green Electronics Council
- UC Berkeley
- NIST
## Metals Recycling

### Problem Statement:
Metals recovery from electronic product recycling is focused on high-volume and most valuable metals that are easily recoverable. Current and future electronics will contain small amounts of resources that are available for recovery but are not currently recovered in today’s recycling infrastructure.

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<tr>
<th>Project Leader(s):</th>
<th>Adam Wheeler (IBM), Carol Handwerker (Purdue)</th>
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<tbody>
<tr>
<td><strong>Purpose and Scope of Project</strong></td>
<td><strong>Project Tasks</strong></td>
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<tr>
<td>• Conduct an analysis of the needs and readiness of current and future materials recovery, focusing on metal recovery, as it applies to consumer electronics, enterprise electronics and future ICT. The trend toward miniaturization to increase functionality and the introduction of new heterogeneous materials systems and technologies create new challenges with respect to materials supply, materials recovery, and electronics recycling. Understanding how these interact, and their impact on metals recycling will assist us in making materials and technology choices both now and in the foreseeable future.</td>
<td>• Identify materials and future product technology trends that the recycling/recovery industry will be handling in the near future. This will permit an assessment of the readiness of the recycling industry for coming changes in materials and products. • Assess the current state of the recycling systems and technologies in use. • Identify Gaps and provide recommendations of how to increase the readiness for future materials recovery.</td>
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### Status Update
TC approved the initiative to be a project 8/17. Call for participation webinar 10/31. Sign-up through November 15. Kickoff Meeting Early December.
Project Summary

• Problem
  – Metals recovery from electronic product recycling is focused on high-volume and most valuable metals that are easily recoverable. Current and future electronics will contain small amounts of resources that are available for recovery but are not currently recovered in today’s recycling infrastructure.

• Opportunity
  – Provide pro-active recommendations for increasing the ability of future recycling systems to meet demands for recovered materials in a sustainable way.

• Goal
  – Understand the current and future readiness of the recycling infrastructure and provide recommendations throughout the entire life-cycle to better enable more efficient metals recovery
iNEMI Project on Metals Recycling

SOW Review

Carol Handwerker
Scope of Work (Phase 1)

Conduct an analysis of the needs and readiness of current and future materials recovery, focusing on metal recovery, as it applies to consumer electronics, enterprise electronics and future ICT.

The trend toward miniaturization to increase functionality and the introduction of new heterogeneous materials systems and technologies create new challenges with respect to materials supply, materials recovery, and electronics recycling.

Understanding how these interact, and their impact on metals recycling will assist us in making materials and technology choices both now and in the foreseeable future.
Key Objectives (1 of 3)

1. Identify materials and future product technology trends that the recycling/recovery industry will be handling in the near future. This will permit an assessment of the readiness of the recycling industry for coming changes in materials and products.
Key Objectives (2 of 3)

2. Assess the current state of the recycling systems and technologies in use.
   a) Develop map of the existing recycling systems.
   b) Develop a high-level assessment of the roles of the economic actors in the life-cycle chain, including product designers, EoL collectors, processors, and treatment facilities, with an eye to future needs.
   c) Develop a decision tree for use along the supply chain on potential choices for systems to increase efficiency of material recovery.
3. Identify Gaps and provide recommendations of how to increase the readiness for future materials recovery.
   a) Develop projections regarding future demands for recovery of an increasing diversity of metals (metal species, processing and smelting technologies, metallurgy, etc.).
   b) Project future opportunities for and expectations of the recycling industry.
   c) Identify system needs to meet these opportunities and expectations.
## IS / IS NOT Analysis – Phase 1

<table>
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<tr>
<th>This Project IS:</th>
<th>This Project IS NOT:</th>
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<tr>
<td><strong>Focusing on Metals Recycling – some plastic contaminant optimization/handling for metal recovery</strong></td>
<td>Developing smelter processes, or other end-processes, or pre-processing (sorting and separation processes)</td>
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<td><strong>Developing a list of existing applicable literature, pilot studies and build upon this work. ID what activities are going on.</strong> - Recommendation of applicability to electronics industry</td>
<td>Assessing recycling of any other materials (plastics, paper, etc.), except for some plastic contaminant optimization/handling for metal recovery</td>
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<td><strong>Developing a map of the recycling system</strong> - Recommendation of what elements to follow in the mapping activity (metal types, chemistry, etc.)</td>
<td>Attempting to identify or prioritize specific “critical” metals for recovery</td>
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<td><strong>High-level Assessment of roles of different stakeholders in the life-cycle chain through the lens of future needs</strong></td>
<td>Repeating existing work</td>
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<td><strong>Metals recycling from consumer electronics, enterprise electronics, and future ICT</strong></td>
<td>Developing Standards or Certifications</td>
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<td><strong>Analysis of current state of the art of the recycling systems and technologies in use (Efficiency, Economics, etc)</strong> - Recommendations/Gap Analysis of how this relates to readiness for future materials recovery</td>
<td>Creating new implementation activities</td>
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<td><strong>Guidance, Best Practices, Recommendations for manufacturers, electronic recyclers and other economic actors in the supply chain</strong></td>
<td>Being proscriptive</td>
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<td><strong>End outputs: Public report; iNEMI member-only recommendations for next steps (Phase 2+ or other)</strong></td>
<td>Creating new tools or assessment methods</td>
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<td><strong>High level assessment - User-friendly guide on ability for recovery</strong></td>
<td>Judging effectiveness</td>
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<td><strong>The project will assess how the widest range of metal recovery options can be realized through the EoL supply chain in order to permit market forces, future policy initiatives to determine what options are realized.</strong></td>
<td>Developing product design criteria</td>
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Anticipated output

• This iNEMI sponsored project proposes to understand the current and future readiness of the recycling infrastructure and provide recommendations throughout the entire life-cycle to better enable more efficient metals recovery.
  – The output of the project will be, at a minimum, a public report
  – Future phases of the project may be identified depending upon the findings of Phase 1.
Prospective Participants

At least one representative from the following economic actors:

• Recycling chain
  – Collection schemes
  – Pre-processing
  – Electronic scrap end-processing

• Academic
  – Material flows
  – Recycling/metallurgical process modeling

• Electronics Manufacturer – Consumer, Enterprise, Future looking
  – Consumer electronics producer
  – Enterprise electronics producer

• Electronics Supply Chain
  – PCB, Laminator producer
## Project Plan

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### Task 1: Review existing work and Develop baseline “vocabulary”
- Need to define terms like “efficiency”
- Identifying the product(s) in each sector (consumer electronics, enterprise electronics and future ICT) to model

### Task 2: Develop map of existing recycling systems
- Routes through which equipment goes
  - Inputs
  - Outputs
  - Qualitative evaluation

### Task 3: Assess current state of recycling systems and technologies

### Task 4: Develop high-level assessment of roles of the economic actors in the life-cycle chain

### Task 5: Develop a decision tree for use along the supply chain on potential choices for systems to recover materials

### Task 6: Identify Gaps and provide recommendations for future metals recovery

### Task 7: Write and issue public report
iNEMI Project on Metals Recycling

Summary and Next Steps

Mark Schaffer
Summary and Next Steps

• Project has been approved by the iNEMI Technical Committee
• Open Enrollment for Project Sign-up will continue until November 15, 2013
• More information can be found at the Metals Recycling Project Page

• Steps for Joining the Project
  – Please note: iNEMI membership is required to participate in the iNEMI Project for Metals Recycling. The period for becoming a founding member of this project will close on November 15, 2013. Steps for joining the project are outlined below.
    • For iNEMI members:
      – Complete and sign the project statement
      – Fax the completed statement to +1 (703) 834-2735 or scan + email to infohelp@inemi.org
    • For non-members:
      – Discuss annual membership fees with Bill Bader in North America (bill.bader@inemi.org), Haley Fu in Asia (haley.fu@inemi.org), or Grace O'Malley in Europe (gomalley@inemi.org).
      – Complete the iNEMI membership application. (www.inemi.org)
      – Fax the completed documents to +1 (703) 834-2735 or scan + email: infohelp@inemi.org.
      – Complete and sign the Project Statement
      – Fax the completed statement to +1 (703) 834-2735 or scan + email: infohelp@inemi.org.